Are vertically integrated healthcare providers able to economise on management?

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Abstract

Advocates of hospital mergers often argue that they have the potential to realise reduced expenditure on managerial and administrative staff. It is difficult to establish whether savings arise from integration of providers, particularly if providers in the process of change incur restructuring costs. Moreover, case study information may not be generalisable. This paper attempts to assess whether vertically integrated service provision is associated with lower management costs than non-integrated provision. Empirical estimation is based on data from all English Trusts. In order to make appropriate comparisons, rather than providers being the unit of analysis, data are aggregated to catchment populations. The number of providers serving each population is used as an indicator of integration and factors which may confound the relationship of interest are controlled for. Our preliminary analysis suggests that a common argument advanced in favour of service integration cannot be completely discounted: it appears that in areas with fewer providers and, hence, greater integration, the costs incurred by providers in managing services are lower. However, unless other benefits can be demonstrated, of themselves these lower costs are unlikely to be of sufficient magnitude to warrant integrated service provision.

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1 Introduction

Integrated service provision features in recent re-configurations and mergers of NHS providers, and is often justified as a means of consolidating the financial position of providers (Newchurch and Company, 1994). Between 1993 and 1997, the NHS Executive (NHSE) indicates that 35 hospital Trusts were established in England following merger or re-configuration of existing providers (personal communication with J Beeby 1998). However, there is a lack of clarity about what constitutes a merger: other sources suggest only 16 mergers took place during this period (Greenwood, 1997). Arguably, the number of recent mergers exceeds either figure, because take-overs of Directly Managed Units (providers which did not have self-governing status) are not counted as these did not require Ministerial approval if they were to become part of an existing Trust, and because reconfigurations of services which do not involve merger of entire Trusts are ignored (Ferguson and Goddard, 1997).

Most hospital mergers resulting in a unified organisation involve horizontal integration, whereby hospitals providing similar services join together, such as two acute providers or two community providers. Generally, this form of integration increases market share and reduces competition and is 'analytically the most convenient, politically the most debated, and economically the least important form of organisational expansion' (Robinson, 1996, p157).

Vertical integration, involving merger of (say) acute and community services, is less common and less discussed, but four cases have been approved in the UK since 1992. The introduction of Primary Care Groups, and their proposed development into Primary Care Trusts, which will take responsibility for the provision of both primary and community care services (Department of Health, 1997), suggests that instances of vertical integration may increase in the future. The US health care system has witnessed a trend towards integration among providers over recent years (Robinson, 1994). Largely the result of the internal dynamics of the health care market, provider organisations combine in different permutations to provide (and sometimes purchase) comprehensive services (Rakish *et al*, 1992; Jost *et al*, 1995; Light, 1995; Robinson and Casalino, 1996; Robinson, 1996). The 'integrated care systems' of Health Maintenance Organisations cross the boundaries of acute, community and ambulatory services and cover all aspects of patient care within a single organisational setting (Robinson and Casalino, 1996). The argument in favour of these organisations is that they increase efficiency by reducing transactions costs, by reaping economies of scale and scope, and by securing increased market share (Jost *et al*, 1995, Robinson and Casalino, 1996).

Debate in the UK about the merits of integrated service provision has been stifled by the NHSE which 'strongly discouraged' applications for integrated acute and community Trust status, preferring instead to promote 'strong, independent community units which can respond effectively' to the changing health care environment (NHSE, 1992). While this advice was meant to clarify policy on the application for Trust status by NHS hospitals, it created a degree of inconsistency in relation to the policy for integrated hospital providers. Integrated Trusts continued to be approved in the post 1992 period under 'special circumstances', and existing integrated Trusts were not changed. This has led to a mix of provider profiles in different localities, while at the same time reducing choice about the form in which service provision is organised locally (Newchurch and Company, 1994).

The NHSE policy position on Trust integration was probably more a reflection of ideology than evidence, in part because of the lack of information to support integrated service provision. There is no compelling evidence to suggest that increased concentration results in greater efficiency or better patient outcomes (NHS Centre for Reviews and Dissemination, 1996). Much of the focus of discussion and empirical research into mergers has concentrated on horizontal integration and the conventional way to explore the economic benefits of hospital mergers is to consider the relationship between cost per unit of activity and size. Empirical studies estimating economies of scale generally find little evidence to support lower unit costs beyond 200-400 beds (Aletras, Jones and Sheldon, 1997). This form of analysis is appropriate when considering horizontal integration but is more difficult to apply when undertaking comparative analysis into the economies arising from vertical integration. The potential benefits of vertical integration extend beyond economies of scale, which relate to the volume of activity and exploitation of capacity, to economies of scope, which are secured by expanding the range of service provision and facilitating better continuity of care. Investigation of these economies is prohibited by the inability to adequately define, measure and compare activity across diverse service settings.

Rather than exploring economies in production, this paper has a more circumscribed ambition, focusing on the costs of managing service provision. Enthusiasts argue that a major benefit of merging is the potential for reduced management. Potential savings can be made by avoiding duplicating a chief executive, other senior administrative staff, the chair of the board and non-executive directors. The Chief Executive of a recently merged trust claims to have made financial savings of £500,000 in board and support services (Greenwood, 1997). However, most of the evidence for reduced

management expenditure by integrated service providers remains anecdotal, and if savings are generated in the short term, it is unclear whether they persist over a longer time period. By analysing data from all hospital Trusts in England over a three year period, this paper attempts to establish whether integrated service providers are able to spend less than non-integrated providers on management.

II Data and Methods

Various approaches suggest themselves as a means to determining whether it is cheaper to manage integrated rather than non-integrated service provision. The simplest method is to concentrate only on those institutions which change status over time, to ascertain whether savings are realised as a result of the integration of previously separate organisations. The problems of this approach include the limited number of cases available for analysis, potential difficulties in generalising the results, and an assumption that savings are realised within the period under consideration. Savings may not be evident in the short term, particularly if providers in the process of integration incur restructuring costs. These may outweigh any predicted efficiency gains of merging (Ferguson and Goddard, 1997).

Alternative approaches rely on comparing providers on the basis of their integrated status, and two strategies are possible. One method is to undertake comparison at provider level, whereby management costs are considered a function of the type of organisation concerned. Bivariate analysis suggests differences among types of providers in their proportionate expenditure on management (table 1). On average, non-acute providers spent around 16-19% and 12-14% more on management than acute and integrated providers respectively. This form of analysis, even when undertaken as multiple regression, may reveal whether there are cost differences according to the type of provider, but this may be merely a function of heterogeneous service provision. It cannot be determined from this approach whether it is less expensive to manage a single organisation rather than two separate acute and community units.

The other option is to compare management costs on the basis of the population served. This entails combining data for separate providers to gain a perspective on the total management costs of comprehensive service provision. This approach entails the creation of 'pseudo-institutions' on the basis of each provider's main purchasing health authority, by aggregating details of providers sharing the same main purchaser. The health authority then becomes the unit of analysis, with the number of providers with which it has to deal an independent factor in

explaining management costs. The hypothesis is that the more providers there are, the less integrated the service provision, and the higher the management costs incurred.

The analysis includes all provider Trusts in England, with the exception of ambulance Trusts and specialised children's hospitals, and is based on routine financial data for the three years from 1994/95. Data are derived from the Trust Annual Accounts (TAC), Trust Financial Returns by programme and specialty (TFR2) and published data on management costs (NHSI 1995; 1996). Providers are aggregated into health authority groupings using NHS organisational code data, compiled by the NHSE. Descriptive details of the variables used in the econometric analysis are presented in table 2.

Management Costs

Differences in management costs among providers in the NHS are most likely to be a reflection of the number of staff in managerial or administrative posts, rather than of average salary levels. Salary levels are unlikely to vary substantially because providers have exercised only limited local discretion over pay. Two definitions of management costs are used in the NHS, based on an Audit Commission methodology which quantifies the number and cost of staff in managerial or administrative posts (Audit Commission, 1995). Senior management (M1) includes all staff in senior management posts, excluding those who are primarily clinicians, and senior nurses earning more than £20,000 per year (with the exception of clinical nurse specialists) plus management consultancy. The more encompassing measure of management costs (M2) includes all administrative and clerical staff along with senior management.

M1 data were published relating to 1994/95 but the following year these were supplemented with M2 costs (NHSE, 1995; 1996). Given its availability for longer, the analysis here focuses on estimating M1 expenditure. There is considerable variation among providers in the proportion of their income spent on senior management, ranging from 2.1% to 8.5% in 1994/95, and from 2.4% to 11.0% in 1996/97.

Provider Type

Providers are classified into three groups: acute providers include acute general hospitals and those offering tertiary (specialist) care; non-acute providers include those providing community, mental health or learning disability services alone or in combination; and integrated providers are those providing acute services in combination with the provision of community and/or mental health and/or learning disabilities care. Providers are grouped together on the basis of their sharing the same health authority as main purchaser. In line with the hypothesis that the more providers there are, the less integrated the service provision, health authorities in which Trusts classified as integrated providers tend to purchase from fewer Trusts than do health authorities which have a higher proportion of acute or community providers.

Multivariate analysis

The proportion of income spent on management is a function of a range of factors. Failure to account for these may lead to false conclusions about the relationship between management costs and integrated service provision.

Proportionate expenditure on management may be related to the external market environment. The proportion of revenue derived from general practice fundholders (omitted sources include health authorities, the Department of Health, private payments, and payments from other providers) is included partly as a proxy for the competitiveness of the market and partly as an indicator of the number of purchasers with which a provider has to deal. Recent NHS policy is premised on the belief that these contracting costs can be substantial: one of the rationales behind the formation of Primary Care Groups was to reduce the transactions costs of dealing with multiple purchasers (Department of Health, 1997).

In addition to controlling for income in defining the dependent variable, organisational size has been included in the expectation that larger providers may be able to economise on managerial effort, although there may come a point where returns plateau or decline. Size is not easily defined when comparing providers with differing functions. An obvious indicator, the number of available beds, is not a complete measure for providers whose activities are not geared toward inpatient provision. Consequently, this measure has been supplemented with the number of sites with inpatient facilities in the expectation that management costs may be positively related to working across several facilities. Finally, because analysis is conducted at health authority level, population is included. This is weighted by age, need and the market forces factor as used for health authority funding allocations.

Teaching status is included as a potential factor influencing proportionate expenditure on management. The direction of the relationship between teaching status and management costs is difficult to anticipate. Higher proportionate expenditure may be expected if teaching and research demands more management time than patient care activities. However, lower proportionate expenditure may be observed because of the extra revenue that teaching and research generates.

Finally, because providers in London face higher factor costs, location in the Thames Regions is included as a dummy variable.

Estimation

The estimated equation takes the following form:

$$m_{it} = \alpha + \beta \mathbf{x}_{it} + \epsilon_{it}$$
$$i=1...100;\ t=1...3 \qquad (1)$$

in which m is the cost of senior management as a proportion of income; $\mathbf{x}$ is a vector of explanatory variables; and ϵ represents the residuals. The subscripts i and t denote the number of units (health authorities) and time periods for which data are available.

A time dimension is included because data have been pooled. Both cross-sectional analysis and ordinary least squares (OLS) on pooled data (including dummy variables for each time period minus one) fail to adequately account for (unobserved) effects specific to the individual providers and health authorities. These effects, which will be captured by the error term ϵ, may be correlated with the explanatory variables, leading to inaccurate estimation of the hypothesised relationships (Hausman and Taylor, 1981). Although OLS estimates[1] are reported for comparative purposes, estimation of the above equation has been undertaken using panel data techniques. The panel data estimator specifies the error term as comprising two elements, $\epsilon_{it} = \nu_i + \mu_{it}$, in which ν_i is a residual specific to each health authority, which differs among health authorities but is constant for each one. μ_{it} encompasses the remaining disturbance.

Various panel data techniques are available to estimate equation 1, the most common being the random and fixed effects models. The fixed effects model suffers the disadvantages of assuming no distribution for ν_i and of not being able to incorporate time-invariant regressors in a straightforward manner (although it is possible to retrieve their effect in a two stage process (Kerkhofs and Lindeboom, 1997)). Moreover, because population effects rather than inferences about individuals are sought, the random specification is considered more suitable (Jones, 1998). However, comparison of time-variant regressors in the random and fixed effects model is possible and Hausman's (1978) specification test explores whether the random effects ν_i are uncorrelated with the regressors $\mathbf{x}_{it}$. A significant χ^2 statistic indicates that, if the model is correctly specified, a fixed effects model is to be preferred.

The relationship between management expenditure as a proportion of income and the selected independent variables is hypothesised to take a linear form. This specification implies that the dependent variable will increase by the value of the β coefficient for every unit increase in the value of the independent variable (all else held constant).

A quadratic relationship is hypothesised between proportionate management expenditure and bed numbers, which are included as both continuous and squared terms in the model. The intuition behind this is that proportionate expenditure on management may decline as providers increase in size up to some level, but beyond this higher levels of expenditure are required as (say) problems of co-ordination in larger organisations arise. This accords with the theory of (dis)economies of scale. The validity of this argument is tested by imposing joint restrictions on the coefficients of beds and the squared term.

III Results

Results from the OLS, random effects and fixed effects models are presented in Table 3. The OLS results suggest that the hypothesis that higher proportionate expenditure on management is associated with a less integrated service is correct: there is a positive and significant coefficient on the variable describing the number of providers. The OLS model also satisfies the RESET test. However, this does not explicitly test for individual health authority effects which, if correlated with the regressors, may generate biased and inefficient estimates. The Breusch Pagan Lagrangian multiplier χ^2 test comparing OLS with the random effects model indicates that the these effects are important, and that the random effects model is superior to OLS.

The two models yield quite different conclusions. Fewer variables appear significant in the random effects model and, of those remaining significant, the strength of the relationship is weaker. Failure to account for individual heterogeneity would lead to an over-estimation of the effect of the explanatory variables on proportionate management expenditure.

The random effects model suggests that an additional Trust serving a population increases proportionate expenditure on senior management by 7.6%. As expected, higher management costs are incurred the higher the proportion of income derived from GP fundholders, and for service provision in the Thames Regions.

The relationship between management expenditure and size is interesting. While population size is not significant, management costs are negatively related to the number of sites with inpatient facilities suggesting that managerial effort is greater when co-ordinating services outside the inpatient setting. A quadratic relationship between management costs (m) and the number of beds (a) is indicated by joint

[1] OLS t-ratios are based on robust standard errors to correct for potential misspecification of the error distribution (heteroscedasticity). Failure to account for this invalidates tests of significance (White, 1980).

restrictions on the linear and squared terms in each equation. When $m=c-\alpha a+\beta a^2$, management costs are minimised when $a=\alpha/2\beta$, which occurs at around 350 beds. This is within the range where economies of scale in *production* are generally shown to be reached (Alteras, Jones and Sheldon, 1997).

Unfortunately, despite satisfying the RESET test, the random effects model is not entirely satisfactory. The significant Hausman χ^2 suggests either misspecification or that the random effects are correlated with the regressors. The obvious response is to estimate a fixed effects model, and results are shown in the final column of table 3. The impact on the coefficients is dramatic, none of the variables retaining the significance suggested by the former estimation procedures.

Acceptance of the fixed effects model comes at the expense of the time invariant variables (in this case the London dummy). The model also performs poorly in terms of overall explanatory power. In view of these concerns, rather than concluding that the fixed effects model is to be preferred, the alternative explanation to be drawn from the Hausman test is that the random effects model is misspecified. Without recourse to further data collection, it may be possible to improve the model's performance by decomposing selected (time variant) variables into their within and between effects. This implies that changes in the average have one effect while transitional changes have another. For example, health authorities in which providers merge during the three year period of observation may incur changes in proportionate management costs which differ from that experienced in health authorities where the provider profile remains unchanged.

The first equation reported in table 4 presents estimates from a random effects model in which this hypothesis is explored. The results suggest that, on average, the more providers serving a population, the higher the management costs incurred. However, in health authorities where mergers are taking place, proportionate expenditure on management declines (although this result is not statistically significant).

The same process of decomposition can be employed for other variables displaying substantial differences in their coefficients between the original random and fixed effects models. The second equation in table 4 shows a random effects model in which the within and between effects of the number of providers, weighted population, and the number of beds are separately specified. Of course, for this model to be acceptable, some theoretical justification should be given for separating the effects. For example, it may be that introducing reductions or additions to the bed complement may be more

demanding of management than maintaining the current stock.

Decomposing the effects of bed numbers is further complicated by the hypothesis that the relationship with proportionate management costs takes a quadratic form.[2] As such, five terms are introduced to cover the within and between effects. The linear term a_{it} is decomposed into $a_{it}= (a_{it}-\bar{a})+\bar{a}$, where $\bar{a}$ is the population average. Decomposition of the squared term, $a_{it}^2=[(a_{it}-\bar{a})+\bar{a}]^2$, results in three terms: the deviation from the average squared: $(a_{it}-\bar{a})^2$; the average squared: $\bar{a}^2$; and 2 times the deviation from the average multiplied by the average: $2(a_{it}-\bar{a})\bar{a}$.

The two models reported in table 4 succeed in reducing the χ^2 reported by the Hausman test, but there remains a problem. Moreover, neither model passes the RESET test.

IV Discussion

Our analysis suggests that a common argument advanced in favour of service integration cannot be discounted: it appears that in areas displaying greater integration, the costs incurred by providers in managing services are lower. However, the problems of specifying an appropriate econometric model mean that the findings remain preliminary. Besides estimation problems, a number of cautions must be attached to the analysis.

Empirical analysis at provider level is complicated by the heterogeneity of service provision across institutions, which is related to the type of patients cared for and to differences in the mode of delivery. These facets make it difficult both to define a standard unit of (resource weighted) output and to assess the size of organisations which do not rely on admitting patients to hospital when delivering substantial proportions of their services. Reflecting these problems, there are no universal criteria by which to categorise providers. The analysis here relies on definitions commonly used by the NHSE, but other schema exist. For example, the Audit Commission, NHS Estates, and CHKS each have different systems of classification. Clearly, it is difficult to satisfactorily undertake comparative analysis across different types of provider if there is a lack of consensus about how to broadly define their differences and similarities.

To some extent, by undertaking comparison on the basis of the population served, the difficulties of categorising providers are resolved because it is the integrated nature of service *provision* rather than the description of individual *providers* that is important. But this form of

[2] The following derivation was suggested by Andrew Jones.

analysis itself relies on various assumptions which may not be satisfied in practice. For example, providers are grouped together if they share the same 'main' purchaser, the assumption being that they serve the same community. But generally providers treat patients from various health authorities, and it would be helpful to include a measure of the extent to which providers serve communities other than merely their local population. Moreover, it has been assumed that the fewer providers serving a community, the more integrated the service provision. While it is true that Trusts classified by the NHSE as 'integrated' are less likely to share responsibility for serving a population with other Trusts, reliance on description of providers remains an inexact indicator of service provision.

While integration appears to yield management savings, these are not of a particularly large magnitude, and of themselves cannot be considered sufficient to warrant increased concentration. In fact the figures could be used to argue the case against mergers. Rather than savings, the differences could be thought of as the marginal cost of managing two Trusts rather than one. The difference may not be considered a particularly high price to pay for patient choice or improved access, which are compromised by concentration (Carr-Hill, Place and Posnett, 1997). Commentators on organisational and management theory point to a variety of problems associated with large organisations. Johnston and Lawrence (1991) suggest that managerial inertia may set in making adaptation to change difficult, stifling the innovative impetus of informal relationships, and perhaps proving costly. For instance, it may be necessary to invest in formal internal management processes and sophisticated monitoring methods (Beetham, 1991).

Perhaps in response to these problems, there have been an increasing number of de-mergers and sell-offs in favour of smaller organisational set-ups and streamlining of activities (Miller, 1996). There is greater collaborative experimentation in the form of partnerships, joint ventures and other contractual arrangements in the provision of healthcare (Johnston and Lawrence, 1991). The US experience suggests that integration among health service providers is not the only way to face the challenges of modern service provision nor the only way to provide efficient services. As other commentators have shown, there remains no compelling evidence to support increased concentration of service provision (Ferguson, Sheldon and Posnett, 1997). While, tentatively, this study suggests that economies in management are possible the more integrated the service, savings are not substantial. It is of concern that merger applications continue to be presented despite the lack of evidence that the result will be beneficial.

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Table 1: Bivariate analysis of management costs as a proportion of income

Senior management costs as a proportion of income		number	mean	SD	Significant differences (Scheffe test)
1994/95	Acute providers	157	3.812	0.780	Lower than non-acute providers
	Non-acute providers	144	4.507	0.867	
	Integrated providers	81	4.029	0.677	Lower than non-acute providers
1995/96	Acute providers	162	3.830	0.863	Lower than non-acute providers
	Non-acute providers	149	4.585	0.812	
	Integrated providers	82	4.016	0.570	Lower than non-acute providers
1996/97	Acute providers	160	4.013	1.052	Lower than non-acute providers
	Non-acute providers	147	4.554	0.879	
	Integrated providers	81	4.081	0.521	Lower than non-acute providers

Table 2: Descriptive provider data aggregated by health authority

	1994/95		1995/96		1996/97	
	mean	SD	mean	SD	mean	SD
Senior management costs (% of income)	4.406	0.578	4.402	0.554	4.062	0.512
Fundholding income (% of income)	8.514	4.487	9.834	4.622	14.492	5.250
Weighted population (100,000)	4.874	1.781	4.891	1.800	4.906	1.810
Daily available beds (000)	2.175	0.891	2.108	0.908	2.042	0.908
Number of sites	11.190	6.200	12.090	6.914	12.360	7.275
Number of Trusts	3.840	1.791	3.930	1.850	3.880	1.790
of which % Acute	40.394	20.671	39.760	18.923	39.810	19.034
% Integrated	22.323	28.620	21.752	27.479	21.813	27.569

Table 3: Linear estimation of management costs as a proportion of income

Linear models	OLS		Random effects		Fixed effects	
	β	t ratio	β	t ratio	β	t ratio
Number of providers	0.102	4.822	0.077	2.585	0.048	0.742
Acute status %	-0.006	-2.298	0.000	0.012	0.003	0.828
Integrated status %	-0.003	-1.751	0.001	0.426	0.009	2.177
Fundholding income %	0.024	3.837	0.014	2.102	0.008	0.881
Sites	-0.024	-5.664	-0.017	-2.994	-0.004	-0.585
Weighted population	-0.001	-0.043	0.034	1.053	-0.357	-1.051
Beds (000)	-0.425	-3.040	-0.616	-3.925	-0.392	-1.399
Beds (000) squared	0.063	2.559	0.089	3.256	0.061	1.370
Teaching %	0.042	2.061	-0.001	-0.048	-0.112	-2.054
London	0.563	9.857	0.585	6.451	dropped	
1995/96	-0.049	-0.860	-0.034	-1.077	0.005	0.158
1996/97	-0.501	-7.222	-0.445	-9.233	-0.367	-5.913
Constant	4.777	27.699	4.698	22.107	6.226	3.569
observations		300		300		300
R squared overall		0.551		0.512		0.001
R squared within				0.500		0.545
R squared between				0.515		0.000
p (RESET)		0.218		0.071		0.081
p (beds & beds squared)		0.010		0.000		0.367
Breusch Pagan χ^2				0.000		
Hausman χ^2				0.000		

Table 4: Decomposed random effects models estimating management costs as a proportion of income

Linear models	OLS		Random effects	
	β	t ratio	β	t ratio
Average providers	0.122	3.828	0.120	3.673
Deviation in providers numbers	-0.067	-1.338	-0.015	-0.235
Acute status %	-0.003	-1.268	-0.003	-1.134
Integrated status %	-0.000	-0.190	-0.000	-0.007
Fundholding income %	0.014	2.213	0.014	2.207
Sites	-0.016	-2.979	-0.016	-2.826
Weighted population	-0.013	-0.364		
Average weighted population			-0.013	-0.338
Weighted population deviation			-0.257	-0.756
Beds	-0.617	-4.005		
Beds squared	0.097	3.604		
Average beds			-0.621	-3.142
Average beds squared			0.093	2.561
Beds deviation			-0.634	-2.321
Beds deviation squared			0.741	1.957
2 * deviation * average beds			0.097	2.239
Teaching %	0.008	0.297	0.014	0.489
London	0.577	6.466	0.561	6.178
1995/96	-0.020	-0.639	-0.007	-0.204
1996/97	-0.438	-9.252	-0.429	-8.164
Constant	4.827	22.773	4.815	21.423
observations		300		300
R squared overall		0.544		0.550
R squared within		0.512		0.518
R squared between		0.551		0.556
p (RESET)		0.043		0.027
Breusch Pagan χ^2		0.000		0.000
Hausman χ^2		0.017		0.014